Green Horse Fire/Fuels/Air Quality Report

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Introduction

The Green Horse project is located on the Moose Creek Ranger District within the Nez Perce-Clearwater National Forests. The project area is located in Idaho County approximately 10 miles north-northeast of Elk City, Idaho. The Green Horse project area encompasses approximately 9,500 acres in the O'Hara Creek, Glover Creek-Selway River, Horse Creek, and Upper American River watersheds that drain into the Selway River or South Fork Clearwater River. The main road access to the project area is via Forest Road 443 from the south and Forest Road 464 from the west of the project area.
The legal description for the project area is (township, range, sections):

- Township 31 North, Range 8 East, Sections 4, 9-16, 20-29, 35, and 36
- Township 31 North, Range 9 East, Sections 7, 8, 19-20, 28, and 33

The Green Horse project area is within an area on the Nez Perce-Clearwater National Forest that has been affected by the western hemlock looper and other insects and diseases.

This project is designed to reduce fuel loading in strategic locations, enhance the ability to safely manage a wildfire, and to meet the desired conditions in the Selway-Middle Fork Clearwater River Subbasin Assessment (USDA 2001) and the Nez Perce National Forest Land and Resource Management Plan (USDA 1987).

Propose treatments would consist of:
Regeneration Harvest (approximately 1,510 acres)
Intermediate Harvest (approximately 180 acres**)**
Landscape prescribed burning (approximately 570 acres)
Site preparation (approximately 1,510 acres) for activity-generated fuels using prescribed fire.
Activity fuels disposal (approximately 180 acres) pile burning, or mastication

These actions will reduce hazard trees, hazardous fuels, and wildfire risk by reducing fuel concentrations and modifying vegetation composition and structure thus moving the project area away from hazardous fuel loading and toward desired vegetative conditions. Timber harvest activities described may begin during the summer of 2022. Landscape burning would follow once all Harvest treatments are completed and all activity fuels reduced and/ or removed.

This analysis describes the existing conditions of fire/fuels within the project area and discloses the potential effects of the alternatives to fuels conditions, fire behavior, suppression efforts, safety and the air quality for the proposed Green Horse Project.

Purpose and Need related to Fire/Fuels

Wildfire exclusion has increased risk for large severe wildland fires in many ecosystems (Agee and Skinner, 2005). Based on observed existing conditions, as well as other supporting information (e.g. annual insect and disease aerial detection surveys, national insect and disease risk maps, input from local community members, Forest Plan management direction), there is a need to:

- Improve forest health and provide a sustained yield of resource outputs as directed in the Forest Plan by:
- Reducing the extent of insect and disease infection and

- Altering species composition to include more early seral species that are less susceptible to disease infection.
- Reduce hazard trees, hazardous fuels and wildfire risk:
- Along roads for public and firefighter safety, including ingress/egress;
- To protect timber resources; and
- To maintain recreational opportunities within the area.

The overriding issue concerning fire and fuels revolves around fire hazard and fire risk. Severe fires may seem catastrophic from a human perspective, in these forests they stimulate vegetation regeneration, promote landscape diversity in terms of vegetation types, provide habitat for many species and sustain other ecosystem services (Moritz *et al.* 2014). However, viewing fire as a natural and inevitable hazard and approaching risk management is complicated. In the proposed project area, accumulated fuels have heightened concerns over fire effects to resources, public and firefighter safety, fire behavior potential and the ability to effectively manage a wildfire. As witnessed on the 36,355-acre Wash Fire, and 29-acre Falls Fire. Recent examples of the wide spectrum of fire behavior and inability to safely manage and the costs associated.

Regulatory Direction

Federal Policy

The Review and Update of the 1995 Federal Wildland Fire Management Policy (January 2001) is the primary interagency wildland fire policy document. The Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy (June 20, 2003) was developed and approved under the authority of the Wildland Fire Leadership Council (WFLC) to set forth direction for consistent implementation of the Federal fire policy.

The 2001 Federal Fire Policy and its implementation are founded on the following guiding principles:

1. Firefighter and public safety is the first priority in every fire management activity.
2. The role of wildland fire as an essential ecological process and natural change agent will be incorporated into the planning process.
3. Fire management plans, programs, and activities support land and resource management plans and their implementation.
4. Sound risk management is a foundation for all fire management activities.
5. Fire management programs and activities are economically viable, based upon values to be protected, costs, and land and resource management objectives.
6. Fire management plans and activities are based upon the best available science.
7. Fire management plans and activities incorporate public health and environmental quality considerations.
8. Federal, State, tribal, local, interagency, and international coordination and cooperation are essential.
9. Standardization of policies and procedures among Federal agencies is an ongoing objective.

Guidance for Implementation of Federal Wildland Fire Management Policy 2009 can be found at http://www.nifc.gov/policies/policies_documents/GIFWFMP.pdf

Forest Plan Direction and Desired Condition

The desired vegetative condition of the project area includes modified fuel concentrations, vegetation composition, and vegetative structure which maintain or move the fire regime condition class toward historic fire regimes. Ladder fuels, surface fuels and tree densities that contribute to fire intensity would be reduced. The result of reduced fuel loading in the forest project area would provide firefighters greater success and safety in managing wildfire on national forest lands.

The disturbance processes such as fire, insects and disease, floods, and landslides contribute to functioning ecosystems. Fire plays its natural role where appropriate and desirable but is suppressed where necessary to protect life and resources.

Vegetation conditions can reduce the frequency, extent, severity, and intensity of uncharacteristic or undesirable disturbances from wildfire and insects. Altering species composition to include more early seral species that are less susceptible to disease infection.

The proposed activities that lie within the Green Horse Project planning area are:

Management Area (MA)	Acres
01 – Public Safety	662
10 – Water	72
12- Timber	6,135
16 - Elk	513
17 – Timber/Visuals	205
20 – Old Growth	139
21 – Moose	1,818

Other desired fire and smoke management goals, objectives, standards and guidelines related to this project are shown in Table 1.

Table1. Desired fire and fuels management direction, goals, objectives, standards and guidelines

Nez Perce Forest Plan	Green Horse Project
Forest wide Goal • Protect resource values through cost-effective fire and fuels management, emphasizing fuel treatment through the utilization of material and using prescribed fire. (p. II-2)	Resource values identified in the Green Horse Project: • Timber • Recreation • Wildlife habitat • Open, no forested areas

<table>
<tr><th>Nez Perce Forest Plan</th><th>Green Horse Project</th></tr>
<tr><td>Forest wide Standard
The prescribed fire planned ignition option is for those management areas where burning will be done to achieve management objectives … (p. II-26)</td><td>Management objectives of the Green Horse Project:
reduce fuels
reduce wildfire risk
The intent of landscape burning is to maintain natural openings, reduce surface fuels, litter depth, and ladder fuels; increase canopy base height, and provide a fuel break in strategic locations along Forest Roads 356 and 9716 for wildfire management in the future and public and firefighter safety (EA. p. 5).</td></tr>
<tr><td>Management Area 1 – Public Safety
Description (key points): provide the minimum management necessary to provide for resource protection and to ensure public safety; Open, non forested areas
Standard: Planned and unplanned ignitions, when within prescription, will be allowed to burn to enhance resource values.</td><td>Purpose and Need of the Green Horse Project for both landscape burning and roadside hazard tree removal. (EA. p. 5).</td></tr>
<tr><td>Management Area 12 – Timber, 16 – Big game winter range, 17 – Timber/Visuals
Standard: Planned and unplanned ignitions, when within prescription, will be allowed to burn to enhance resource values.</td><td>reduce fuels
reduce wildfire risk
The intent of activity fuel burning is to reduce surface fuels, litter depth, and ladder fuels; increase canopy base height, as well as provide a fuel break in strategic locations along Forest Roads 356 and 9716 for wildfire management in the future and public and firefighter safety (EA. p. 5).</td></tr>
</table>

Criteria Used for Analysis

The measure to assess on how well each alternative meets the purpose and need pertinent to fuels, fire hazard reduction, and public and firefighter safety are as follows.

Indicators:

Fire Behavior:
Rate of Spread. The rate of spread is in **chains per hour (ch/h)** and is defined as the speed with which the fire is moving away from the site of origin. Wind, moisture, and slope drive the fire. The flaming zone, or fire head, moves away from the origin quickly with great intensity.

Flame Length. Change in potential flame length. Flame lengths generally less than 4 feet are desired, allowing for safe direct attack by handcrews. Flame lengths greater than 4 feet generally require equipment to be employed such as dozers and aircraft; beyond 8 feet torching, crowning and spotting can occur (Rothermel 1972).

Fire Type. One of the following four types:

- ***Surface*** (understory fire)
- ***Torching*** (passive crown fire; surface fire with occasional torching trees)
- ***Conditional crown*** (active crown fire possible if the fire transitions to the overstory)
- ***Crowning*** (active crown fire; fire spreading through the overstory crowns)

(Andrews et al. 2009)

Fire Behavior Fuel Models. Fire behavior fuel models are used as input to the Rothermel (1972) fire spread model, which is used in a variety of fire behavior modeling systems. The fire behavior fuel model input set includes:
• Fuel bed depth
• Fuel load by size, class, and category
• Live woody, live herbaceous, and dead 1-hr SAV (Surface-Area-to-Volume)
• Dead fuel extinction moisture content
• Heat content of live and dead fuels

Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. *Joe H. Scott Robert E. Burgan (2005)*

Bulk Densities. Canopy bulk density (CBD) is the mass of available fuel per unit of canopy volume (lb/ft3 or kg/m3). It is a bulk property of a stand, not an individual tree. CBD is an important crown characteristic needed to predict crown fire spread.

Methodology

Data sources used for this report include GIS data layers. Computer generated summaries and models used in effects analyses include IFTDSS (The Interagency Fuel Treatment Decision Support System, IFT-DSS), and Blue Sky Playground 2.0.

For the purpose of this analysis, IFTDSS automatic 97th percentile landscape fire behavior was used to determine 97th percentile weather day observations. 97th percentile equates to "severe drought conditions". Crown fire Landfire 2014.

Model Limitations:

- The model assumes continuous, uniform, and homogeneous fuel beds.
- The fire model describes fire behavior in the flaming front.
- Fire whirls and other fire-induced disturbances are not modeled; however, they are usually expected with extreme fire behavior

Affected Environment

Background and Existing Condition

Historically, wildland fire was the dominant influence in defining the project area landscape and the native species that adapted and persisted within this dynamic environment. The advent of effective fire suppression effectively removed wildland fire's effects from the Green Horse project area landscape and ecological system. Suppression of wildland fire has increased levels of insect and disease mortality over the landscape are causing an increase in fuel loadings, including higher quantities, greater continuity and distribution.

As a result of fire exclusion resulting from effective suppression and past management, there has been a vegetative shift to more fire intolerant species, an increase in fuel loadings and a proportional increase in the risk of moderate to high intensity and potentially resource-damaging wildland fire. This situation has increased the risk of large, stand replacing wildfire that could adversely impact vegetation, fisheries resources, watershed function, wildlife habitat, recreational safety, and roadway travel. Most recently the Wash fire was a mixed severity fire of 2015 which consumed 36,355 acres north and east of project area.

The Green Horse project area is within an area on the Nez Perce-Clearwater National Forest that has been affected by insects and disease including the western hemlock looper.

Fire History Occurrence

Geospatial data of fire history within the proposed project area from 1889 to present show a total of eight fires over 10 acres have occurred. These eight fires have a combined acreage of 4,137 acres. The project analysis area is approximately 9,500 acres, which means that approximately 43% of the project area has burned within the last 131 years. Of these eight, 5 are less than 100 acres and three are greater than 900 acres in size.

Table 2

Date	Acres
1889	964
1910	84
1919	1939
1934	27
1994	13
1996	20
2015	1061
2017	29
Historic Totals	**4,137**

Most recently the Wash Fire and Falls Fire occurred within the project area or immediately adjacent to the project area (north and east of project).

Fire Behavior

Fire hazard can be characterized by how a fire will burn or fire behavior. Fire behavior is the product of the natural environment or the unique combination of topography, weather and fuels (Countryman 1972). Topography and weather are factors on which humans have little effect but, fuels can be altered through human intervention or natural processes such as fire (rapid) or decomposition (very slow). Therefore, when assessing fire hazard, the focus can be on fuels and the associated fire behavior, determined by fire behavior characteristics such as rate of spread, flame length, fireline intensity, torching, crowning, spotting, fire persistence and resistance to control.

Resistance to control is a relative measure of the capabilities of firefighting resources to suppress a wildland fire. Firefighting resources have enhanced production rates as fuel loading and fuel-bed depth decrease. Increased fireline production rates and changes to lower fireline intensities allow both ground based and aerial suppression resources to be more effective.

Fireline intensity is widely used as a means to relate visible fire characteristics and interpret general suppression strategies. There are several ways of expressing fireline intensity. A visual indicator of fireline intensity is flame length (Rothermel 1983). These flame length classes and interpretations are familiar to fire managers and are widely accepted as an intuitive communications tool. Table **3** compares fireline intensity, flame length, and fire suppression difficulty interpretations.

Table 3. Fireline intensity interpretations

Fireline Intensity	Flame Length ft	Rate of Spread ch/h	Interpretations
Low	1-4	2-5	Direct attack at the head and flanks with hand crews; handlines should stop spread of fire.
Moderate	4-8	5-20	Fires are too intense for direct attack on the head by persons using handtools; handline cannot be relied on to stop fire spread; equipment such as dozers, engines, and retardant aircraft can be effective.
High	8-12	20-50	Fires may present serious control problems such as torching, crowning, and spotting; control efforts at the fire head are likely ineffective; this fire would require indirect attack methods.
Very High	12-25	50-150	Crowning, spotting, and major fire runs are probable; control efforts at the head are likely ineffective; this fire would require indirect attach methods.

Surface Fuels and Fuel Models

Surface fuels. Excessive fuel loads created through insects, disease, decadence and fire exclusion now occur over large portions of the project area.

Insects and Disease. Insects and disease hazard trees now occur over large portions of the project area roadways.

Heavy Surface Fuel Loadings in project area.

Fuels in the analysis area include surface and aerial fuels. Surface fuels include all combustible material lying beneath or on the forest floor, including downed trees, roots, rotten logs, duff, and woody debris. Aerial fuels consist of trees, shrubs, and low-growing branches on trees that allow fires to move from the surface to the tree canopy.

In order to quantify the effects of a wildfire, a fuel model is selected to use as input to the fire spread model. A fuel model is defined by a set of fuel bed inputs needed for a particular fire behavior or fire effects model. A fuel model is chosen by the primary carrier of the fire (e.g. grass, brush, timber litter, slash) and its fuel characteristics (e.g. fuel loading, surface area to volume ratio, fuel depth, etc).

Three Fire Behavior Fuel Models were used to represent *existing fuel conditions* throughout the project area. *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model Joe H. Scott Robert E. Burgan June 2005*

FIRE BEHAVIOR FUEL MODELS:

Grass-Shrub Fuel Type Models (GS)
The primary carrier of fire in the GS fuel models is grass and shrubs combined; both components are important in determining fire behavior. All GS fuel models are dynamic, meaning that their live herbaceous fuel load shifts from live to dead as a function of live herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model

FBFM. GS2. Moderate Load, Dry Climate Grass-Shrub (Dynamic)
The primary carrier of fire in GS2 is grass and shrubs combined. Shrubs are 1 to 3 feet high, grass load is moderate. Spread rate is high; flame length moderate. Moisture of extinction is low.

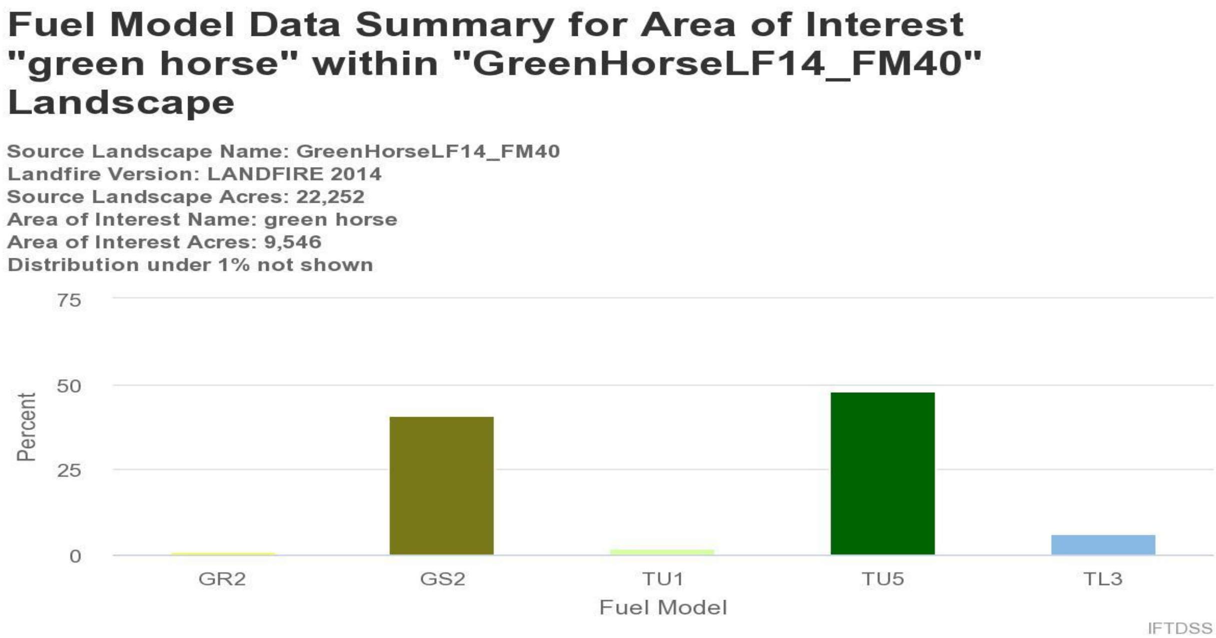
Timber Litter Fuel Type Models (TL)
The primary carrier of fire in the TL fuel models is dead and down woody fuel. Live fuel, if present, has little effect on fire behavior.

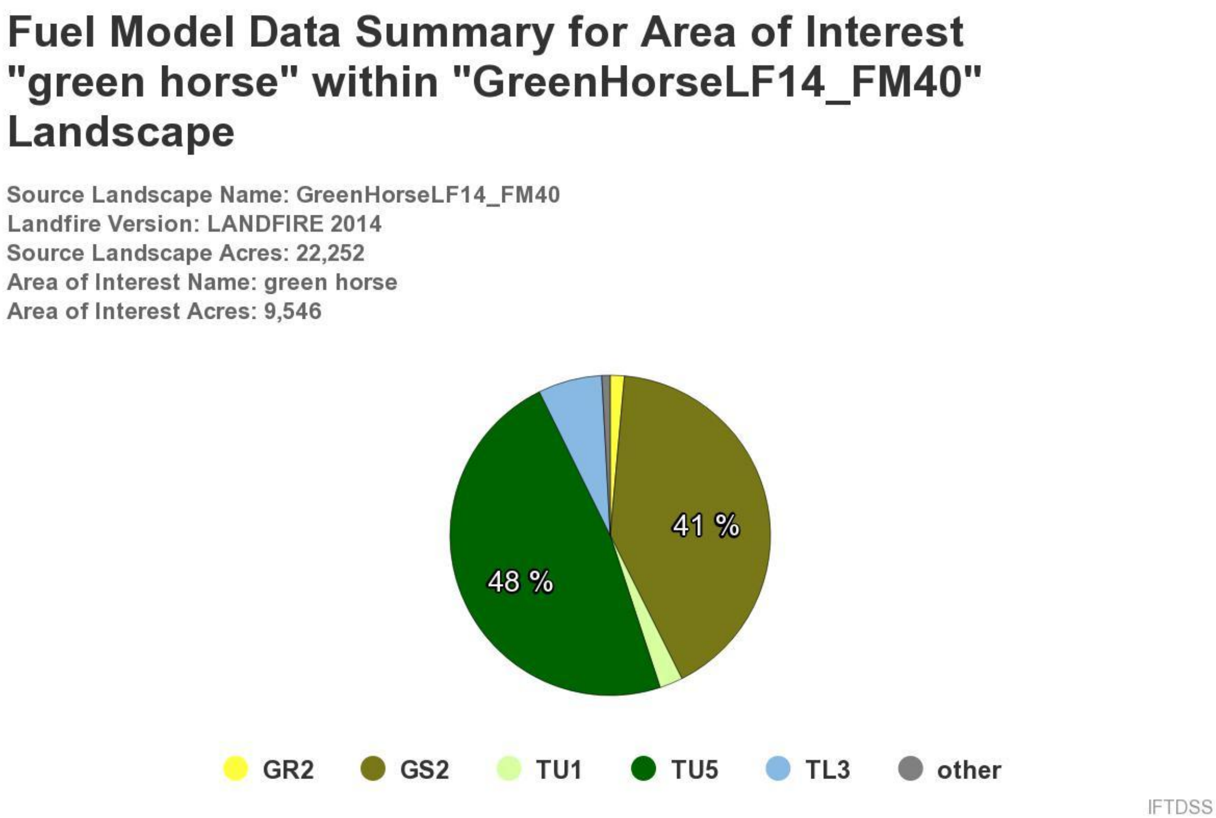
FBFM. TL3 Moderate Load Conifer Litter
The primary carrier of fire in TL3 is moderate load conifer litter, light load of coarse fuels. Spread rate is very low; flame length low.

Timber-Understory Fuel Type Models (TU)
The primary carrier of fire in the TU fuel models is forest litter in combination with herbaceous or shrub fuels.

FBFM TU5. Very High Load, Dry Climate Timber-Shrub
The primary carrier of fire in TU5 is heavy forest litter with a shrub or small tree understory. Spread rate is moderate; flame length moderate.

Table 4. Fire Behavior Fuel Model percentages across project area





Fire Regime

The natural fire regime is a classification of the role fire would play across the landscape in the absence of modern human intervention but including the influence of aboriginal burning (Keane *et al.* 2003; Agee 1993). It is characterized by fire frequency, seasonality, intensity, duration, and patch size. "Historical fire regimes" describe the relative frequency of fire assumed to have occurred prior to fire suppression. The terms used for the different fire regimes are: nonlethal, mixed 1, mixed 2, and lethal. Nonlethal are generally the lowest intensity and severity with smallest patches of mortality, while lethal fires are generally of highest intensity and severity with the largest patches of mortality. The others fall in between.

The natural or historical fire regimes are classified by number of years between fires (frequency) and the severity of the fire on the dominant overstory vegetation. Fire return intervals in the project area generally fall into natural fire regime groups as defined in table 5.

Table 5. Fire regime types

Fire Regime	Fire Interval	Fire Intensity	Vegetation Patterns (Agee 1998)
Nonlethal	5–25 years	≤10% mortality	Relatively homogenous with small patches generally less than 1.0 acre of different seral stages, densities, and compositions created from mortality.
Mixed1	5–70 years	>10–50% mortality	Relatively homogenous with patches created from mortality ranging in size from less than 1.0 to 600 acres of different seral stages, densities, and compositions.
Mixed2	70–300 years	>50–90% mortality	Relatively diverse with patches created by mixes of mortality and unburned or underburned areas ranging in size from less than 1.0 to 25,000 acres of different seral stages, densities, and compositions.
Lethal	100–400 years	>90% mortality	Relatively homogenous with patches sometimes greater than 25,000 acres of similar seral stages, densities, and compositions. Small inclusions of different seral stages, densities, and compositions often result from unburned or underburned areas.

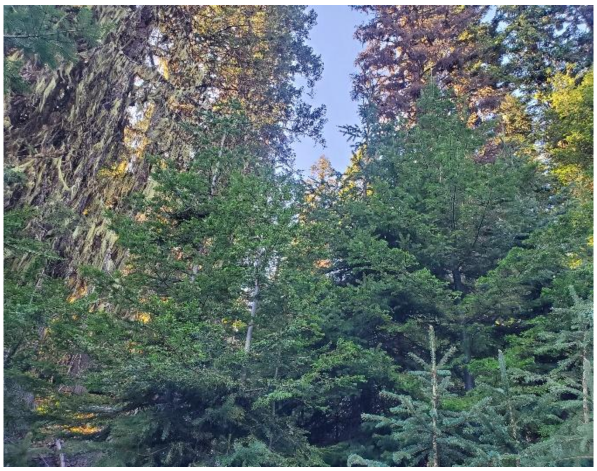
Most of the Green Horse Project area (9,162 Acres) fall within the Fire Regime Group III: Mixed 2. With fire intervals of 70 to 300 year, relatively diverse with patches created by mixes of mortality and unburned or underburned areas ranging in size from less than 1.0 to 25,000 acres of different seral stages, densities, and compositions.

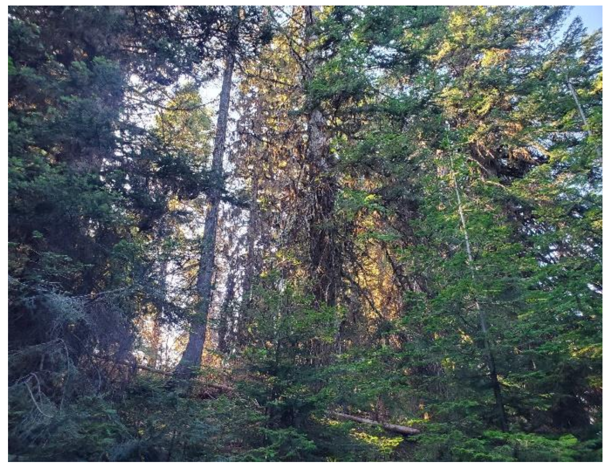
Most of the stands in the project area have had no large fire for a long period of time (estimated at about 100+ years) since fire suppression has occurred. In general, many of the stands proposed for treatment are densely stocked. Stands are developing understory (fuel ladders) as well as increased concentrations of surface fuels. Currently, insects and disease are altering stand composition and increasing surface fuel loading within the project area, but without the fire. These changes mean that potential fire behavior in these areas would likely be more intense and more difficult to control than if trees were more widely spaced with fewer trees. The most effective way to reduce crown fire occurrence and severity is to (1) reduce surface (ladder) fuels, (2) increase the height to live crown, (3) reduce canopy bulk density, and (4) reduce the continuity of the forest canopy (Graham *et al.* 2004). In general, ground fires are less dangerous and easier to control than crown fires.

Canopy Characteristics

Crown Fire Potential

Crown fire potential is generally based on the amount of surface fuels, the amount of ladder fuels, and the density and spacing of the canopy. Heavy surface fuels generally contribute to longer flame lengths. Low canopy base heights can carry surface fire into the crowns. Once established the crown fire may persist. The more spaced the canopy, the greater the wind necessary to move fire from one crown to the next. Dense canopies would require much less wind speed to support crown fire.





Dense stands with close spacing, surface fuels and ladder fuels within project area.

Canopy Base Heights

Canopy base height (CBH) is the lowest height above the ground where there is a sufficient amount of canopy fuel to transition a fire from the surface fuels into the tree crowns (Scott and Reinhardt 2001). Therefore, low canopy base heights are a critical factor in determining crown fire potential. Fuels treatments should focus on removing some or all of the ladder fuels and other vegetation that contributes to a low canopy base height, especially where reducing crown fire initiation is a priority.

The structure and species composition of the stands – specifically Grand Fir and Spruce with low growing crowns, as well as dense understory trees - in the project area are contributing to the low canopy base heights. The fuels continuity from the surface fuels to the crown fuels has created the potential for surface fire to propagate to the crowns of the overstory trees.

Low canopy base height within project area.

Canopy Bulk Density (CBD)
CBD affects the critical spread rate needed to sustain active crown fire. The lower the canopy bulk density, the lower the potential active crown fire. For existing conditions werer derived from IFTDSS Landfire 2014 as well as comparing site-observations.

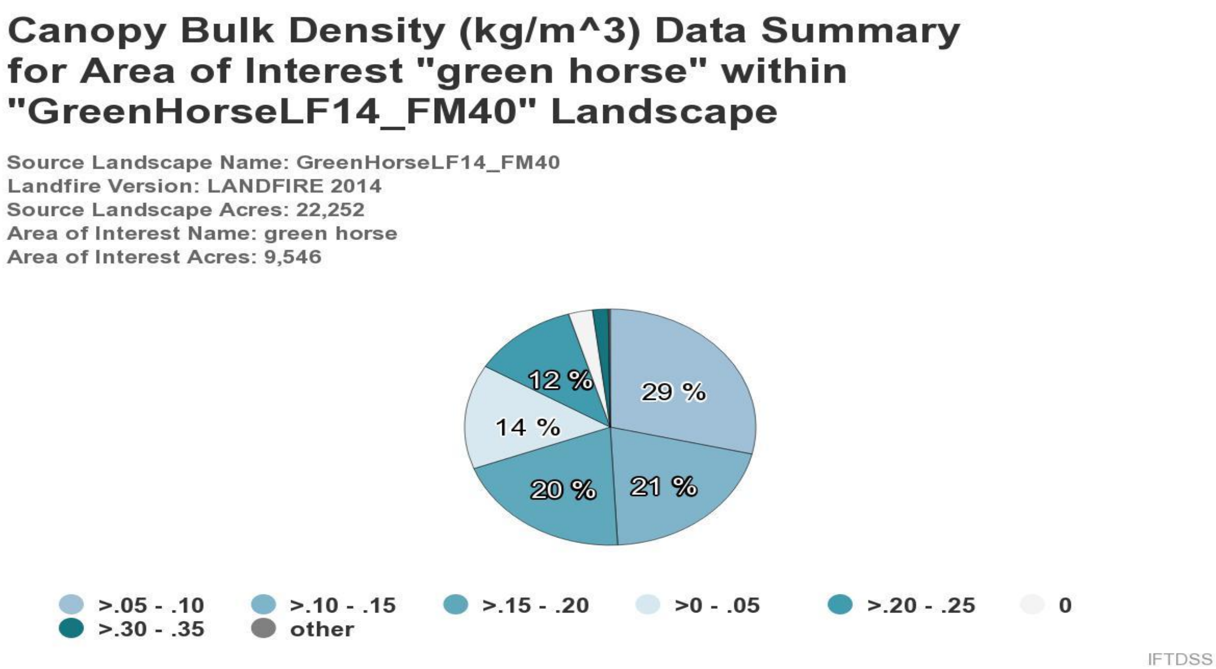


Table 6. Existing Fuel Conditions Model Outputs for project area (Outputs from IFTDSS Severe Drought 97th percentile)

Project Indicators	Acres of project area	Percentage of project area
Rate of Spread (chains per hour)	715	7
<0-2	486	5
<2-5	2969	31
>5-20	3259	34
>20-50	2050	21
>50-150	67	1
>150		
Flame Length (feet)		
>0–1	556	6
>1–4	507	5
>4–8	849	9
>8–11	771	8
>11–25	2277	24
>25	4587	48
Fire Type Frown Fire Activity		
Surface Fire	1062	11
Passive Fire	7225	76
Active fire	1259	13
Fuel Model		
FBFM TL1	0	0
FBFM GS2	3932	41
FBFM TL3	617	6
FBFM TU5	4557	48
Canopy Bulk Density		
0 (non-forested)	257	3
>0-.05	1367	14
>.05-.10	2737	29
>.10-.15	1959	21
>.15-.20	1919	20
>.20-.25	1124	12
>.25-.30	17	0
>.30-.35	165	2
>.40	2	0

Environmental Consequences
Alternative 1 – No Action

Direct and Indirect Effects

Effects on Fuel Conditions and Fire Behavior
The no-action alternative would not alter the fuels condition in a way that reduces fire behavior. Flame lengths, rates of spread, and fire type would remain similar or slightly increase over time: therefore, there would be no beneficial direct effects regarding forest fuels or fire behavior. With no modification of fuel loading and forest structure, fire behavior under normal, summer conditions would persist as described under the existing condition, threatening resources within the project area and adjacent to the project area. The Fire Regime class would remain or slightly increase in severity. It would become more difficult to use fire to manage vegetation to enhance ecosystem resiliency, maintain current or desired fire regimes, lower hazardous fuel levels, and achieve the desired conditions. Fire would still be allowed to play its natural role where appropriate and desirable but would be suppressed where necessary to protect life and resources.

Effects on Fire Behavior Fuel Models
Fire Behavior Fuel Models would remain similar with a slight increase in fuel loading over time.

Effects on Bulk Densities
The no-action alternative would not alter continuity and density of canopy within the project area and it would remain at similar levels or slightly increase from describe in existing conditions.

Effects on Suppression efforts, and Safety
The no-action alternative would retain hazard trees along road systems which would continue to be a safety concern for public and firefighter's safety.

In the absence of any kind of human-caused or natural disturbance, indirect effects would occur from the natural progression of forest growth and change. Any increase in surface, ladder, and crown fuels would affect flame length, contribute to the torching of trees, and make crown fire more likely (Peterson *et al.* 2005, Graham *et al.* 2004). Wildfires that escape initial attack are likely to become large and damaging. Direct fire suppression tactics would not be as effective as compared to the proposed action. Fire risk in the project analysis area would likely increase and contribute to wildfires that could become more difficult and more costly as conditions worsen with time.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans
The no-action alternative would not be responsive to the Forest Plan or National Fire Plan goals. Fire suppression activities would still occur within the project area.

Alternative 2 – Proposed Action

Prescribed Fire/ Fuel Treatments.

Prescribed burning in Regeneration harvest units will be used to reduce and/or remove activity fuels generated after mechanical treatment activities or to remove/reduce natural fuels that have accumulated due to natural forest succession, insect and disease, blow down or past fires.

Prescribed burning is also utilized to prepare the site for planting, improve wildlife habitat and stimulates regeneration of many tree, shrub, forb and grass species. Prescribed burning would be conducted based on weather and site-specific conditions and would take place under the guidelines set forth in a prescribed fire burn plan developed specifically for this project area. Only one prescribed fire entry will be implemented to reduce activity generated fuels in harvest units.

Intermediate harvest Activity fuels may be treated with prescribed burning through hand-or-machine piling; and then burning the piles, or mastication of activity-generated fuels on slopes less than 35% and on ground that is machine operable.

Landscape Prescribed fire treatments. Prescribed fire goals are to mimic the characteristic fire regime. (Noss et al. 2006) Allowing progress towards the restoration of ecological processes to help maintain current fire regimes, transition to historic fire regimes, and to enhance ecosystem resiliency. Objectives are to maintain natural openings, reduce surface fuels, litter depth, and ladder fuels; increase canopy base height (the distance from the ground to the bottom of the tree canopy), and provide a fuel break in strategic locations along Forest Roads 356 and 9716 for wildfire management in the future for public and firefighter safety. The intent of ignition is to achieve a mix of low-and-medium-intensity surface fire. Some individual or group torching of trees may occur in the units, creating a mosaic of burned/unburned vegetation. Areas of overstory tree mortality would be expected up to approximately 3 years post-burn.
The burning of natural fuels may occur more than once with an interval between implementation due to seasonal availability and desired fire effects, and objectives. Ignitions would occur after all harvest treatments have been completed, and all activity fuels reduced and/ or removed.

Prescribed Fire would occur during periods when weather conditions and fuel moisture levels are within favorable windows to facilitate low to medium intensity surface fire. Prescribed burning would be conducted based on weather and site-specific conditions and would take place under the guidelines set forth in a prescribed fire burn plan developed specifically for this project area. Not all landscape burning acres identified would be treated either due to the fuel availability during burning period or at the discretion of the prescribed fire manager. Forested areas within the proposed prescribed fire units may be thinned and/or limbed prior to burning to reduce fuel loadings. Burning would reoccur as needed to keep a current and functional fuel break for the safety of public and firefighters in the project area.

Unplanned ignitions may be managed for resource benefit within the units identified for prescribed burning where it meets the objectives described above.

Direct ignitions in the RHCA, including landslide prone areas shall be avoided; fire will be allowed to back into these areas. No ignition would occur outside of mapped units; however, fire would be allowed to back into areas outside of the units. Fire outside the units as would be allowed to burn as long as objectives are met, and resource values enhanced.

Direct and Indirect Effects

Harvest activities and Landscape fire models were used to represent post project fuel conditions throughout the project area.

Table 7. Post-Treatments Fuel Conditions Model Outputs for project area (Outputs from IFTDSS Severe Drought 97^{th} percentile)

Project Indicators	Acres of project area	Percentage of project area
Rate of Spread (chains per hour)		
<0-2	730	8
<2-5	568	6
>5-20	3302	35
>20-50	3634	38
>50-150	1283	13
>150	30	0
Flame Length (feet)		
>0–1	512	5
>1-4	2349	26
>4–8	807	8
>8– 1	604	6
>11–25	1670	17
>25	3515	37
Fire Type Frown Fire Activity		
Surface Fire	3009	32
Passive Fire	5741	62
Active fire	796	8
Fuel Model		
FBFM TL1	52*1498	1*16
FBFM GS2	2983	31
FBFM TL3	542	6
FBFM TU5	3657	38
Canopy Bulk Density		
0 (non-forested)	1725	
>0-.05	1468	18
>.05-.10	2285	15
>.10-.15	1537	24
>.15-.20	1443	16
>.20-.25	932	15
>.25-.30	13	10
>.30-.35	142	0
>.40	1	1
		0

Effects on Fuel Conditions and Fire Behavior from Proposed Treatment

Under the Proposed action, treatments are expected to create variation in stand structure and break up fuel continuity. Basic principles as described by Peterson and others (2005) that reduce fuel loading, ladder fuels, and stand density will reduce potential fire intensity, torching of trees and crown fire. All of these principles have been integrated into the design of the proposed action of the Green Horse Project. However, in extreme weather conditions, such as drought and high winds, fuel treatments may do little to mitigate fire spread or severity (Pollet and Omi 2002). Alteration of the fuels condition would reduce fire behavior by decreasing flame lengths to a manageable level, reducing high rates of spread to a lesser rate range, and altering the fire type to a higher surface fire percentage over the project area. There would be beneficial direct effects regarding forest fuels or fire behavior. With modification to fuel loading and forest structure fire behavior would be in a more desirable range for suppression activities and management of natural ignition fires and protecting timber resources. Under the proposed action progress would be made towards the restoration of ecological processes to help maintain current fire regimes, transition to historic fire regimes, to enhance ecosystem resiliency and lower hazardous fuels. Fire would still be allowed to play its natural role where appropriate and desirable but would be suppressed where necessary to protect life and resources.

Effects on Fire behavior Fuel Models from Proposed Treatment

Under the proposed action, progress would be made towards maintaining current FBFM GS2 Grass-Shrub Fuel Type Model, and TL3 Timber Litter Fuel Type Model conditions thru landscape prescribed fire. A 10% reduction in the heavily loaded FBFM TU5 Timber Understory Fuel Type Model by altering species composition to include more early seral species that are less susceptible to disease infection on appx.16% of project area.

Effects on Bulk Densities from Proposed Treatment

The proposed action alternative would lower canopy bulk density, this alteration of continuity and density of canopy within the project area will reduce Crown fire probabilities. Allowing safer management of wildfire within the project area.

Effects on Suppression efforts, and Safety from Proposed Treatment

Under the proposed action alternative, there would be a decrease in the number of dead and dying trees adjacent to roads and other infrastructure. This would lead to better ingress/egress for firefighters and the public, a reduction in the extent of insect and disease and a reduction in hazardous fuels along roadways, while likely maintaining forested cover within the roadless area. There would be a reduction in potential fire behavior because flame lengths would be decreased, rates of spread decreased, and fire types modified to more surface based fire within the Green Horse project area. Keeping a wildfire out of the tree crowns and on the surface will aid firefighters to safely manage a wildfire, as well as reducing the chance of an unwanted wildfire event. Landscape burning will maintain natural openings, reduce surface fuels, litter depth, and ladder fuels; increase canopy base height, and provide a fuel break in strategic locations along Forest Roads 356 and 9716 for wildfire management in the future and public and firefighter safety.

Table 8. Direct and indirect effects for the proposed action

Treatments	Resource Indicator	No Action	Proposed Action
Prescribed fire (Activity fuels) Prescribed Fire (Landscape)	Rate of Spread	There would be no alteration or slight increase to spread rates.	50-150ch/h decreasing 8% Distributing it into 5-20 and 20-50ch/h Reducing hazardous fuels, and wildfire risk.
Prescribed fire (Activity fuels) Prescribed Fire (Landscape)	Flame Length	There would be no alteration or slight increase to flame length.	25+ ft flame length decreasing 13% 11-25 ft flame length decreasing 4% Reducing hazardous fuels, and wildfire risk.
Prescribed fire (Activity fuels) Prescribed Fire (Landscape)	Fire type	There would be no alteration or slight increase to fire type.	Surface Fire increases 20% Passive Fire decreasing 15% Active(crown)Fire decreasing 5% Reducing hazardous fuels, and wildfire risk.
Prescribed fire (Activity fuels) Prescribed Fire (Landscape)	Fuel Model	There would be no change in Fire Behavior Fuel Models.	Positive alteration and maintenance of Fire Behavior Fuel Models: TU5 decreasing 10% TL3 Maintaining at 6% GS2 Remaining above 30% Altering species composition to include more early seral species that are less susceptible to disease infection on appx.16% of project area.
Prescribed fire (Activity fuels) Prescribed Fire (Landscape)	Bulk Density	The no-action alternative would not alter continuity and density of canopy within the project area and it would remain at levels describe in existing conditions.	Positive alteration of continuity and density of canopy within the project area. Reducing Crown fire probabilities. Allowing safe management of project area. Reducing hazardous fuels, and wildfire risk.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The proposed action complies with the Nez Perce Land Management Plan goals, standards, and guides and National Fire Plan goals.

Air Quality

This section describes the characteristics and relevant rules, regulation, and laws related to air quality. It also discloses the effects that the various alternatives would have on air quality.

The basic framework for controlling air pollutants is the 1970 Clean Air Act, as amended in 1990. The Clean Air Act is designed to "protect and enhance" air quality, and requires the Forest Service to protect administered lands from adverse effects of anthropologic air pollution. The standards for this compliance were set through the National Ambient Air Quality Standards (NAAQS). There are no mandatory Class I airsheds or nonattainment areas within the project area, therefore elements pertaining to general conformity do not apply.

The Environmental Protection Agency (EPA) has established NAAQS for six air pollutants; carbon monoxide, ozone, nitrogen dioxide, sulfur dioxide, lead, and particulate matter. The pollutants of main concern for this project are particulate matter 10 and 2.5 associated with smoke emissions because of potential impacts on human health and visibility. The NAAQS for PM-10 (particulate matter less than 10 micrometers in aerodynamic diameter) were established in 1987 and updated in December of 2006 and again in December of 2011. The NAAQS for PM-2.5 (particulate matter less than 2.5 micrometers in aerodynamic diameter) were established in 1997 and updated in December of 2011. Although PM-2.5 causes more severe health effects and visibility impacts than PM-10, the PM-10 standards were retained because they also have the potential to cause significant health effects. The majority of particulate matter from smoke emissions is usually in the PM-2.5 size class. According to the NAAQS, PM-10 cannot exceed 150 micrograms/cubic meter (ug/m3) within a 24 hour period and PM-2.5 cannot exceed 35ug/m3 within a 24 hour period either alone or in combination with existing pollution sources.

An area that violates the NAAQS is designated as "nonattainment". For the purposes of regulating ambient air quality, the Idaho DEQ does not have baseline data for the affected environment. However, air quality in the project area is generally good to excellent due to the lack of urban and industrial sources and a minimum of other activities (vehicle dust and emissions) in the area that would generate pollutants.

The Montana/Idaho Airshed Group, of which the Nez Perce- Clearwater National Forest is a member, was formed in 1998 and yearly releases its operating guidelines for public and private land managers within Idaho. The objective of those guidelines is to coordinate prescribed burning among members to minimize smoke-related impacts to air quality. Idaho DEQ has certified to the EPA that the operations of the Montana/Idaho Airshed Group meet the Basic Smoke Management Program elements described in the interim air quality policy. The Montana/Idaho Airshed Group monitors daily emissions, burning activities, and particulate matter levels with established monitoring units and certified meteorologists.

The Montana/Idaho Airshed Group tracks smoke inputs across the two states by "airshed". Airsheds are geographical areas delineated by similar atmospheric characteristics (Operating Guide, June 2010). The Airshed Group also identifies population centers within these airsheds that are sensitive to smoke.

Class I Areas are subject to the most stringent restrictions relative to additional air pollution. The Clean Air Act established the national visibility goals of preventing any future, and the remedying of any existing, impairment of visibility in mandatory Class I Areas where impairment results from man-made air pollutants. The EPA's regional haze regulations (July 1, 1999) require that all states develop visibility plans to address regional haze impairment of Class I Areas within their state, as well as Class I Areas outside of their state that may be affected by emissions from within their state.

Table 9. Lists the Class I Areas, population centers, and other sensitive areas.

The project area lies within the Montana/Idaho Airshed ID-13 and in Idaho County. Particulate matter is the primary pollutant of concern related to Forest management. The Selway-Bitterroot Wilderness is the closest Class I area.

Table 9: Smoke Sensitive Areas

Sensitive Receptors	Airshed #	Distance Air Miles	Direction from Project Area	Within Direction of prevailing wind Y/N
Selway Bitterroot Wilderness (Class 1 Area)	13	10	East	Y

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects

No management created smoke would be created in comparison to the Proposed Action assuming no wildfire occurs. However, in the event of a wildfire, smoke production could exceed levels produced under the Proposed Action and may occur at less favorable times (e.g. inversion) and durations (e.g. longer smoldering phase under low duff moistures).

Alternative 2 – Proposed Action

Direct and Indirect Effects

For the purposes of this analysis, the web-based application Blue Sky Playgound was used to model smoke production, dispersion, and potential impacts on sensitive areas, population centers, and Class 1 Airshed Areas. Models were run based on #208 - Grand fir-Douglas-fir forest.

<u>Landscape Prescribed Burning</u>: The model was run assuming no more than 100 acres natural fuels burned on any given day. Weather conditions assumed for prescribed burning in mid-September to mid-October were 30% 1000-hr fuel moisture, 50% shrub consumption, and 0% canopy consumption.

<u>Prescribed Burning (Activity fuels):</u> The model was run assuming no more than 50 acres would be broadcast burned on any given day. Weather conditions assumed for prescribed burning in mid-September to mid-October were 10% 10-hr fuel moisture, 15% 1000-hour fuel moisture. The fall scenarios for burning would likely be granted by the Montana / Idaho Airshed Group. It is assumed ignition would stop around 1600 for the model day.

Figure 1: Green Horse Landscape Prescribed Fire Fall Smoke Dispersion – Daily Average Concentration

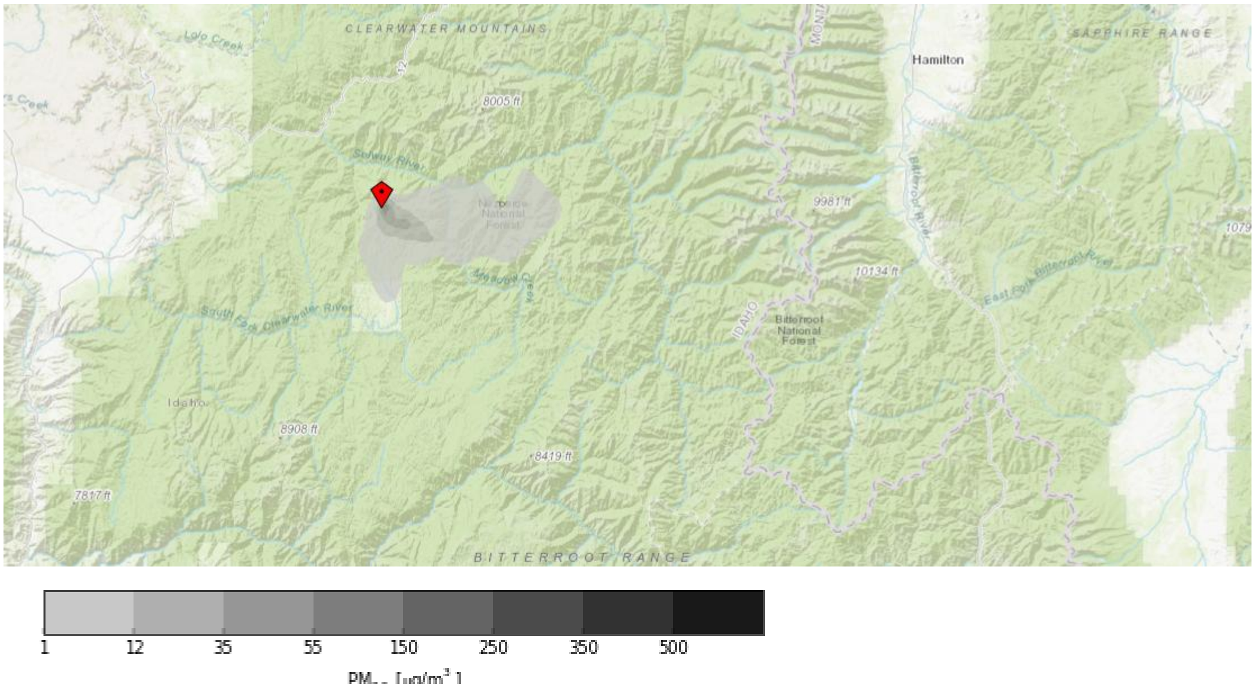


Figure 2: Green Horse Landscape Prescribed Fire Fall Smoke Dispersion – Daily Max Concentration

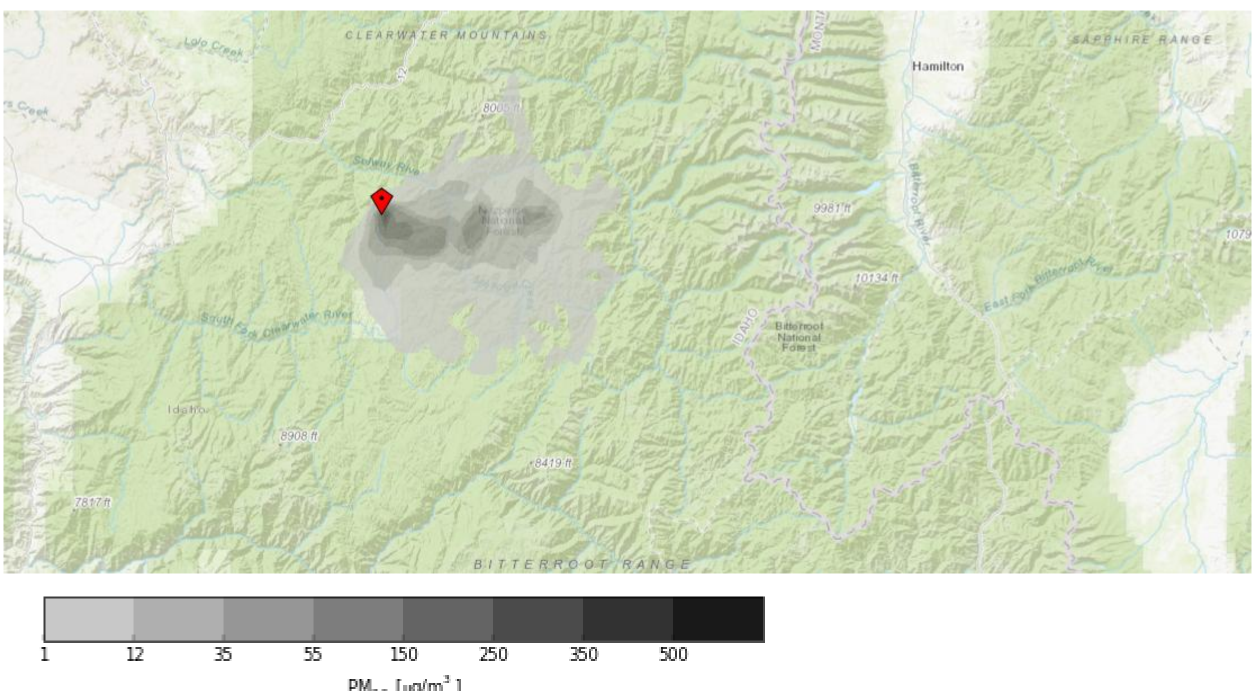


Figure 3: Green Horse Prescribed Fire Fall Smoke Dispersion – Daily Average Concentration

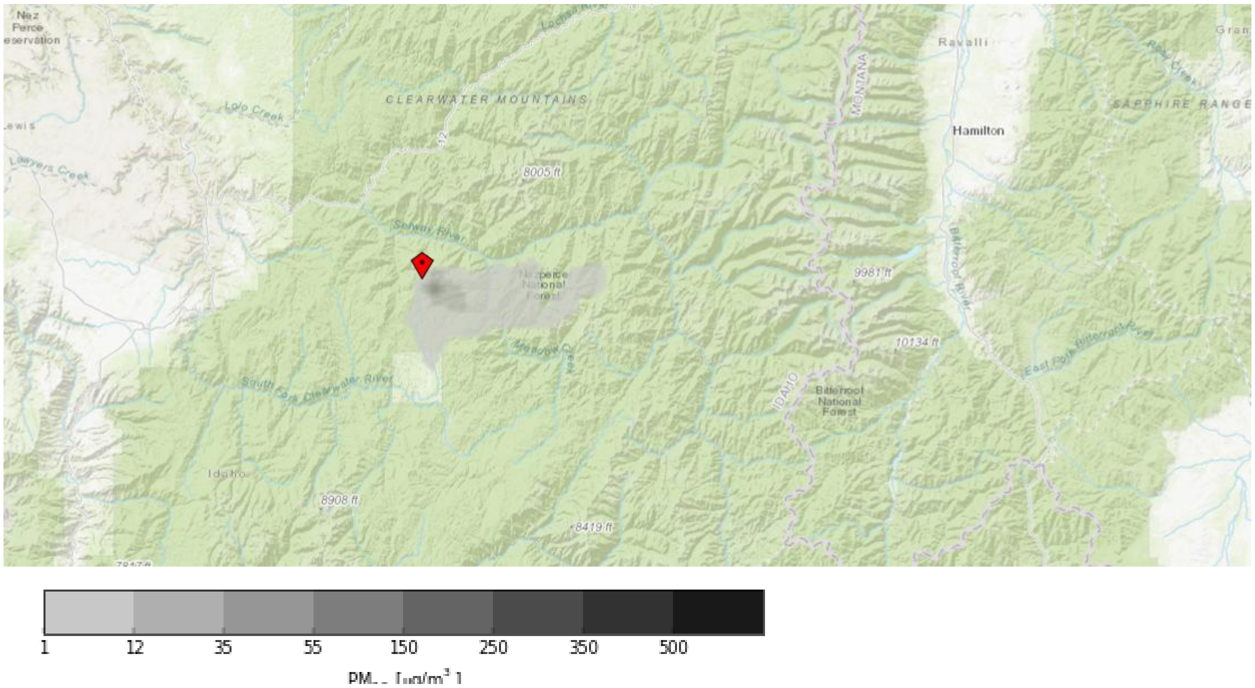
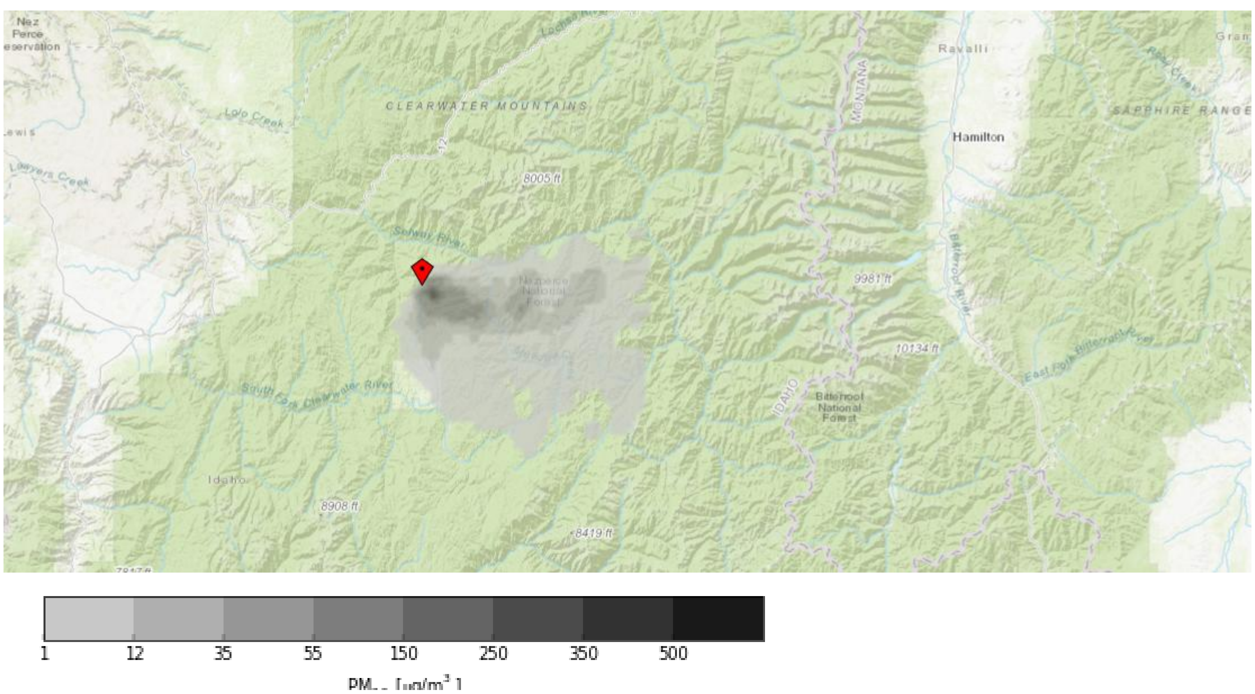


Figure 4: Green Horse Prescribed Fire Fall Smoke Dispersion – Daily Max Concentration



Smoke dispersal output generated by Blue Sky Playground for broadcast burning indicated that impacts to sensitive areas will be within compliance. Output indicated that PM-2.5 generated by broadcast burning would be below NAAQS(figures 1-4). The Selway-Bitterroot Wilderness is the most probable area to be impacted (10 miles to the East). Bluesky Playground estimates that the daily max concentration for a 50 acre fall burn would be less than 35 PM-2.5 IF DIRECTLY DOWNWIND. Because burning will be coordinated through the Montana / Idaho Airshed Group, it is unlikely the smoke would combine with smoke from other projects or a wildfire to cumulatively exceed air quality standards.

References

Agee, J.K. 1993. Fire ecology of Pacific Northwest forests. Island Press, Washington, DC. 493p.

Agee, J.K.; Skinner, C.N. 2005. Basic principles of forest fuels reduction treatments. Forest Ecology and Management 211 (1-2): 83-96.

Arno, S.F.; Parsons, D.J.; Keane, R.E. 2000. Mixed-Severity Fire Regimes in the Northern Rocky Mountains: Consequences of Fire Exclusion and Option for the Future. In: Cole, D.N.; McCool, S.F.; Borrie, W.T.; O'Laughlin, J.; Comps. Wilderness science in a time of change conference – Volume 5; wilderness ecosystems, threats, and managements; 1999 May 23-27; Missoula, MT. Proceedings RMRS-P-5-Vol-5. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. p. 225-232.

BlueSky Playground, https://tools.airfire.org/

Countryman, C.M. 1972. The Fire Environment Concept. Pacific Southwest Forest and Range Experiment Station, U.S. Department of Agriculture, Forest Service, Berkely, CA. 15p.

Graham, R.T.; McCaffrey, S.; Jain, T.B.; (technical editors). 2004. Science basis for changing forest structure to modify wildfire behavior and severity. General Technical Report RMRS-GTR-120, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO. 43p.

IFTDSS- The Interagency Fuel Treatment Decision Support System, https://iftdss.firenet.gov/

Keane, R.E.; Cary, G.J.; Parsons, R. 2003. Using simulation to map fire regimes: An evaluation of approaches, strategies, and limitations. International Journal of Wildland Fire 12: 309-322.

Montana/Idaho Airshed Group. June 2010. Montana/Idaho Airshed Group Operating Guide.

Mortitz, M.A.; Batllori, E.; Bradstock, R.A.; Gill, A.M.; Hanmer, J.; Hessburg, P.F.; Leonard, J.; McCaffrey, S.; Odion, D.C.; Schoennagel, T.; Syphard, A.D. 2014. Learning to coexist with wildfire. Nature 515: 58-66.

Nez Perce National Forest Land and Resource Management Plan (USDA 1987).

Noss et al. 2006. Managing fire-prone forests in the western United States. Front. Ecol. Environ. 484p.

Peterson, D.L.; Johnson, M.C.; Agee, J.K.; (and others). 2005. Forest structure and fire hazard in dry forests of the western United States. General Technical Report PNW-GTR-628, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR. 30 p.

Pollet, J,; Omi, P.N. 2002. Effect of thinning and prescribed burning on crown fire severity in ponderosa pine forests. International Journal of Wildland Fire 11: 1-10.

Rothermel, R.C. 1983. How to predict the spread and intensity of forest and range fires. General Technical Report INT-143, U.S. Department of Agriculture, Forest Service, Intermountain Range and Experiment Station, Ogden, UT.

Rothermel, R.C. 1972. A mathematical model for predicting fire spread in wildland fuels. Res. Pap. INT-115. Ogden, UT: U.S. Department of Agriculture, Intermountain Forest and Range Experiment Station. 40 p.

Scott, J.H.; Reinhardt, E.D. 2001. Assessing Crown Fire Potential by Linking Models of Surface and Crown Fire Behavior. RMRS-RP-29. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 59 p.

Scott, J.H.; Reinhardt, E.D. 2005. Stereo photo guide for estimating canopy fuel characteristics in conifer stands. General Technical Report. RMRS-GTR-145. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 49p. plus stereoscope.

Scott, Joe H.: Burgan, Robert E. (2005) Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model.

Selway-Middle Fork Clearwater River Subbasin Assessment (USDA 2001)